REMARKS/ARGUMENTS

Favorable consideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-4, 6-7, 9-11, 15-19, 21-30, 32-40, 42-49, 51-52 and 54-59 are presently pending in this application Claims 1, 3-4, 6-7, 9-10, 15, 18, 22, 24-25, 32, 42, 44, 47-49, 51-52 and 54-56 having been amended, and Claims 5, 8, 12-14, 20, 31, 41, 50, 53 and 60 cancelled by the present amendment.

In the outstanding Office Action, Claims 1-7, 9-13, 16-21, 24-32, 35-40 and 44-60 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kakii et al. (U.S. Patent 5,764,833) in view of Nakanishi et al. (U.S. Patent 6,655,856); and Claims 8, 14, 15, 22, 23, 33, 34 and 41-43 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kakii et al. in view of Nakanishi et al., in further view of Porter et al. (U.S. Publication 2004/0228601).

Turning now to the merits, Applicants' invention is directed to an optoelectronic module and method of sealing such a module. As discussed in the Background section of Applicants' specification, conventional optoelectronic modules include a diode array chip that is delicate and subject the mechanical damage during alignment and assembly of the module, and in many uses requires a high degree of hardening, environmental protection and reliability.[1] For this reason, the conventional optoelectronic modules are typically packaged in costly sealed housings, or require a labor intensive two step epoxy encapsulation process.[2] Having recognized these specific problems associated with conventional optoelectronic modules, Applicants' invention is directed to addressing these problems.

[1] Applicants' specification at paragraphs 9 and 10.
[2] Applicants' specification at paragraphs 11 and 12

In one embodiment of the disclosed invention, an enclosure provides mechanical protection of the components during alignment and assembly, and the enclosure also provides containment of fluid transparent epoxy such that the epoxy does not run from a desired area in an uncured state.[3] Further a hole or opening can be provided in the enclosure to inject the epoxy therein in order to facilitate the assembly process.

In order to expedite issuance of a patent in this case, independent Claims 1, 10, 18, 25, 44 and 54 have been amended to clarify patentable features of the present invention over the cited references. Specifically, Claim 1 recites

> "...a resin encapsulating said array in said cap, said resin being substantially transparent to light wavelengths passing between said array and said fiber facets, wherein
> said cap has an injection hole therein for introducing said resin in an initially fluid uncured state into a chamber formed by said cap, said submount and said end face of said optical fiber block such that the fluid resin is contained by said cap in said uncured state."

Thus, Claim 1 has been amended to recite an optoelectronic module including a resin encapsulating an array in a cap, and the resin is substantially transparent to light wavelengths passing between the array and the fiber facets. Further, the cap includes an injection hole therein for introducing the resin in an initially fluid uncured state into a chamber formed by the cap, the submount and the end face of the optical fiber block, such that the fluid resin is contained by the cap in the uncured state. The cap serves as a containment dam for the fluid sealing resin. When cured, the sealing resin hardens to encapsulate the chip and its wire bonds within a generally transparent solid resin mass. The resin mass covers and encapsulates the chip and also the fiber facets so as to fill the space therebetween. In one embodiment, the resin mass may extend to form a plug of resin rising from the interior of chamber to seal injection hole.

[3] Applicants' specification at paragraph 13.

Kakii et al. is directed to an optical fiber array, and shows an optical fiber array having an optical coupling end face to be optically coupled to another optical line. As seen in Figure 20 of Kakii et al., a case 31 is provided at the exterior of the parallel optical transmission module M, and the optical fiber array F is bonded to this case 31. As also seen in Figure 20, the end face of the case and the end face of the optical fiber array F make a reference plane.

Nakanishi et al. is directed to an optical module. As seen in Figure 3 of this reference, an optical fiber 34 and a laser diode 30 are mounted on a single substrate 29. The substrate 29 is mounted inside an inner container 26 for containing a transparent resin 35, and further mounted within an outer container 25 for a fixing resin 36 formed on a common bottom plate 27. The transparent resin 35 guides light to the section between optical fibers, or between an optical fiber and an optical element. The refractive index of this transparent resin is almost the same as that of the optical fiber 34. Figure 15 shows the container alone without the substrate or optical fiber coupled thereto. As seen in Figure 15, the container is a double container composed of separate inside and outside containers in which the bottom plates are different, sidewalls are provided, and the upper portion is opened, wherein the bottom portion of the inner container is coupled to the bottom portion of the outer container. A lid is provided on the outer container .

However, Kakii et al. and Nakanishi et al. do not disclose a resin encapsulating an array in a cap, an injection hole for introducing the resin into a chamber formed by the cap, the submount and the end face of the optical fiber block, or the cap having an injection hole for introducing the resin in an initially fluid uncured state into the chamber. That is, the combination of Kakii et al. and Nakanishi et al. do not teach or suggest the above-quoted limitations of Claim 1, as amended herein.

The Office Action admits that Kakii et al. and Nakanishi et al. do not disclose an injection hole for introducing the resin in an initially fluid uncured state into the chamber, but cites Porter et al. as teaching this feature. The cited reference to Porter et al. discloses a visual alignment mechanism for a collimator and beam spreader. As seen in Fig. 1, of this reference, the core 30 of an optical fiber 24 passes through a torroidal member 38 that is provided within a cavity 37. The cavity includes a hole 36 for injecting epoxy therein in order to secure the torroidal member 38 in place. Thus, Porter et al. merely discloses the general concept of injecting epoxy into a hole, without disclosing that the hole is provided in a cap of the enclosure as recited in Claim 1. Thus, the combination of Kakii et al., Nakanishi et al. and Porter et al. do not disclose all of the limitations of amended Claim 1.

Even assuming that Porter et al. discloses an injection hole as recited in Claim 1, this reference dos not disclose an optoelectronic module at all. As discussed in the Background section of Applicants' specification, and as summarized above, it is the present inventors that recognized that conventional optoelectronic modules do not provide effective sealing of the optical device array in an efficient assembly process. Without this recognition, one of ordinary skill in the art would not be able to predict the inventive arrangement now claimed, and which addresses these problems. Thus, it would not be obvious to combine the features of Kakii et al. and Nakanishi et al. with Porter et al. to arrive at the present invention. Thus, Claim 1 is not obvious over Kakii et al., Nakanishi et al. and Porter et al.

Independent Claims 10, 18, 25, 44 and 54 recite features similar to Claim 1 as follows:

> Claim 10 ...a resin encapsulating said diode array in said spacer, said resin being substantially transparent to light transmissions between said diode array and said fiber facets, wherein said spacer is bonded to said submount and to said end face for sealing said diode array and said fiber facets, and said spacer has a resin injection port therein for admitting a sealing resin into a chamber formed by said spacer between said submount and said end face.

Claim 18 ... wherein said cap cooperates with said fiber block to define a fluid containment enclosure encompassing said laser diode array chip, and said method further comprising applying liquid resin through a hole in said fluid containment enclosure to encapsulate said laser diode array chip.

Claim 25 ...wherein said containment dam cooperates with said optical fiber block to make a closed chamber containing said diode array and said fiber facet array, said closed chamber including a hole or opening for admitting said liquid resin into said closed chamber.

Claim 44 ...wherein said chamber forming device also defines a fluid containment dam about said array and the chamber includes a hole or opening therein for admitting a liquid epoxy resin into fluid containment dam, and wherein said array is encapsulated in said epoxy resin contained by said dam.

Claim 54 ...wherein said containment dam cooperates with said end face to define a fluid containment enclosure encompassing said diode array chip and the method further comprising applying liquid sealing resin through a hole or opening in said fluid containment enclosure to said diode array chip thereby to encapsulate said chip in said resin.

Thus, each of these independent claims is also directed to an enclosure of some sort that can provide mechanical protection during assembly, and can also contain epoxy in an uncured state, the epoxy being provided in a hole or opening in the enclosure. As discussed above, the cited prior art does not disclose or render obvious this combination of features. Therefore, the cited references to Kakii et al., Nakanishi et al. and Porter et al. do not disclose these limitations for similar reasons to those discussed above with respect to Claim 1.

For the foregoing reasons, Claims 1, 10, 18, 25, 44 and 54 are believed to be allowable. Furthermore, since the remaining pending claims in this case depend from one of the independent claims distinguished above, these dependent claims also patentably define over the cited references.

In view of the amendments and discussions presented above, Applicants respectfully submit that the present application is in condition for allowance, and an early action favorable to that effect is earnestly solicited.

Respectfully submitted,

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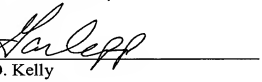

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